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INCREASING RETURNS AND UNEMPLOYMENT  
EQUILIBRIUM

M.L. Weitzman

Number 291

October, 1981

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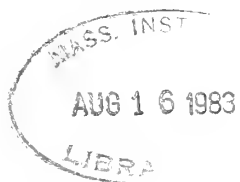
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## Increasing Returns and Unemployment Equilibrium

### Summary

Current approaches to macroeconomic theory divide, roughly, into two basic schools of thought. One approach, typically associated with "rational expectations", views the economy as basically at or near market clearing equilibrium, in which case it becomes very hard to convincingly explain away the undeniable persistence, at times, of involuntary unemployment. Another approach views the underemployed economy as being in a state of temporary disequilibrium, in which case, even leaving aside suspicions that the essence of effective demand failures might not have to do with prices fixed at "wrong" values, there is a lot of rationalizing to be done about why adjustments are so slow. This paper argues that it is possible, and even plausible, to have something like a consistent theory of steady state unemployment in the more or less usual sense of general equilibrium; that is, individual economic agents have no incentive to change their optimizing behavior under conditions which their very behavior sustains, and yet there is persistent involuntary unemployment. The cornerstone of this third approach is increasing returns to scale, which blocks unemployed agents from breaking out of a low level equilibrium trap unless there is overall coordination or stimulation. A simple model is presented which contains the basic ideas.

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Introduction: Unemployment as a Failure of Coordination

I should begin by describing the phenomenon I am trying to explain.

"Unemployment equilibrium" is persistent involuntary underutilization of the major factors of production, caused by insufficient aggregate demand. The market system suffers from a "failure to coordinate" the desired consumption and production plans of all agents because the unemployed lack the means to communicate or make effective their potential demands.

In a modern economy, many different goods are produced and consumed. Each firm is a specialist in production, while its workers are generalists in consumption. Workers receive a wage from the firm they work for, but they spend it almost entirely on the products of other firms. To obtain a wage, the unemployed worker must first succeed in being hired. However, when demand is depressed because of unemployment, each firm sees no indication it can profitably market the increased output of an extra worker. The inability of the unemployed to communicate effective demand results in a vicious circle of self-sustaining involuntary unemployment. It is difficult to rigorously describe this kind of unemployment, much less explain it, in an artificially aggregated economy that produces essentially one good.

Unemployment equilibrium as a story about effective demand failure coexists uneasily with classical general equilibrium theory. Most economists deal with both concepts, but in a kind of schizophrenic manner. Unemployment and classical versions of equilibrium theory are not just different approaches; in a fundamental sense they seem to represent almost incompatible paradigms.

Classical general equilibrium theory starts at a very basic level by specifying tastes, technology and endowments. The world is peopled by atomistic economic agents who optimize. They interact impersonally through purely competitive markets. There are no genuine economic organizations. Prices adjust freely and Say's Law guarantees full employment of factors. An elegant and complete answer is given to the "what, how, and for whom" question. Major issues concern efficiency and the determination of relative prices.

By comparison, effective demand theory appears to lack a thoroughly consistent microeconomic specification. At least implicitly, the effective demand approach involves a behavioral cleavage of decision roles among different agents, and the existence of genuine organizations. The key idea is that insufficient aggregate demand will cause output to fall below the full employment level. Without remedial action, the economy can get stuck in underemployment states. Prices play a negligible adjustment role in clearing markets and Say's Law does not operate. Primary emphasis is on policy measures the government can take to correct unemployment.

In their methodology, assumptions, and conclusions, the two approaches represent very different world views. If not mutually exclusive, they are at

least difficult to reconcile. All this notwithstanding, in some sense the average mainstream economist pledges allegiance to both paradigms. Predictably, that kind of intellectual schizophrenia frequently results in confusion.

If unemployment equilibrium is viewed as a form of steady state general equilibrium theory, why does it differ so radically from the classical version? On the most basic level of tastes and technology, which hidden assumption marks the first dividing line?

In this paper I want to argue that the ultimate source of unemployment equilibrium is increasing returns. When compared at the same level of aggregation, the fundamental differences between classical and unemployment versions of general equilibrium theory trace back to the issue of returns to scale. A crucial distinction is whether or not the underlying technology is convex. Classical equilibrium is essentially organized around the postulate of constant returns to scale. The assumption of increasing returns to scale provides a basic organizing principle for unemployment equilibrium theory.

More formally, I hope to show that the very logic of strict constant returns to scale must imply full employment, whereas unemployment can occur quite naturally with increasing returns. In this sense, unemployment equilibrium is tied to an underlying technology of increasing returns, just as classical general equilibrium is bound up with constant returns. If that is a fair way of looking at the matter, small wonder inconsistency or confusion can result from trying to apply the concepts and tools of one environment to the other.

The paper presents a simple general equilibrium model -- perhaps it is more accurate to call it an example -- which clearly indicates the connection between microeconomic increasing returns to scale and macroeconomic involuntary unemployment. A closed, circular-flow economy based on increasing returns is constructed which yields unemployment equilibria as a natural consequence. Needless to say, constructing this kind of specialized model is more an exercise in logical consistency than a serious attempt to derive policy conclusions. While it is, ultimately, important to understand the microeconomic foundations of macro-theory and to reconcile classical and unemployment versions of general equilibrium theory, the benefits to a practicing macroeconomist are likely to be quite indirect.<sup>1</sup>

#### Introduction to the Model: Tastes and Technology

To focus as sharply as possible on basic issues, the paper deals with a very simple model having extreme symmetry properties.

Consumers derive their ultimate satisfaction from characteristics which are embodied in specific commodities. People differ in their preferences for the underlying characteristics. A person of a given attribute preference type wants commodities to be as close as possible to his type. Suppose there is a natural one dimensional preference ordering for attributes from 0 to H which allows them to be meaningfully represented as points on a circle of circumference H that begins at 0 and ends at H, where 0 and H coincide.

The population of N people is uniformly distributed in attribute preference types around the circle. Suppose the marginal rate of

substitution between "quantity" and "quality" is constant. If a person of attribute preference type  $i$  is given  $x$  units of commodity  $j$ , his utility is

$$V_i(x, j) = x - \mu|i-j| \quad (1)$$

where  $\mu$  is a positive constant and  $|i-j|$  represents the arc distance on the circle from  $i$  to  $j$ .

A consequence of the above formulation is that each person specializes to the consumption of just one type of product. An alternative interpretation avoids this unrealistic feature while yielding the same aggregate behavior. Think of each person as a composite of random preference atoms distributed uniformly around the attribute circle. Every atom is itself like a hypothetical modular consumer with the extreme preferences given by (1). The demand attributed to each person is the expected demand over uniformly distributed preference atoms. This interpretation, which makes everyone a generalist in consumption, is more like the formulation I have in mind, although the story is somewhat easier to exposit in the analytically equivalent world where consumers are specialists.

To clearly understand the role of differing assumptions about technology, we resort to a fictional account of the evolution of a hypothetical economy which passes through three stages of technological development. Even though it is stretching history to talk about three modes of production as if they actually occurred in this precise sequence, it is nevertheless analytically very useful to imagine an economy that evolved this way.

In each case we are working with one factor of production. At the level of abstraction of an entire economy, this single factor is meant to represent a composite of every factor in the economy. Combining together all factors of production eliminates the possibility of relative factor unemployment and forces the model to focus sharply on the issue of absolute unemployment, which is the crux of an effective demand failure. We imagine, then, that various kinds of labor, capital, land, and natural resources can be miraculously aggregated into a meaningful index number, which we henceforth call "labor" in honor of the major factor. Each of the  $N$  persons in our mythical economy is endowed with one unit of labor.

On the output side, no distinction is made between goods and services, between real and financial activities, or between production and distribution.

### I: Self Sufficiency

Suppose each laborer can produce  $\alpha$  units of any commodity. In such a world the economic problem has a trivial Robinson Crusoe solution. A person of attribute type  $i$  simply produces and consumes  $\alpha$  units of commodity  $i$ . There is no need for trade in this economy, since everyone specializes to production of the commodity he most prefers. Of course it does no harm if we think of each person as hired to produce what his neighbor likes and then buying his own preferred commodity. Either way there is no possibility of unemployment because everyone has the fallback option of retreating into autarchy. With the price of a unit of output fixed at one, the real wage in stage I is  $\alpha$ .



## II: Small Scale Specialization

Now suppose a person of type  $(i,j)$  prefers to consume  $i$  but has a comparative advantage in producing  $j$ . For simplicity, assume  $i$  and  $j$  are independently, uniformly distributed throughout the population. A person of type  $(i,j)$  can produce  $\beta$  units of commodity  $j$ , or  $\alpha$  units of any other commodity, where

$$\beta > \alpha. \quad (2)$$

Suppose a competitive market opens up where people can costlessly buy and sell commodities. The only possible competitive equilibrium occurs when the prices of all the goods are the same. In competitive equilibrium a person of type  $(i,j)$  produces  $\beta$  units of  $j$  and sells it in order to buy  $\beta$  units of  $i$ . If the price of commodity  $i$  is raised higher than the price of other commodities, the demand for  $i$  will fall below its supply, as some persons with attribute preferences very near  $i$  switch over to close substitutes.

Although it is perhaps easiest to think of each person as self employed, there is no difficulty imagining a situation where several people with a comparative advantage in producing a certain commodity are hired for wages by a shadow firm. Under competitive equilibrium, the real wage must be  $\beta$ .

In such an economy there can be no true unemployment because there are no true firms. If anyone is declared "unemployed" by a firm, he can just announce his own miniature firm, hire himself, and sell the product directly on a perfectly competitive market. While the "unemployed" worker of type

$(i,j)$  is busy producing commodity  $j$  and selling it directly, an "unemployed" worker of type  $(j,i)$  is simultaneously supplying the market with commodity  $i$ .

#### Returns to Scale, Market Structure, and Say's Law: A Digression

The basic conclusions of last section extend to the modern formulations of classical general equilibrium theory. With hardly any loss of generality, the production side can be represented by a constant returns to scale activity analysis model. Diminishing returns is correctly viewed as a partial equilibrium phenomenon having to do with the effects on output of varying one set of inputs while another set is held constant.

Once granted the powerful assumptions of strict constant returns to scale and perfect competition, the essential logic of an adjustment mechanism which eliminates unemployment seems inescapable. Unemployment equilibrium is impossible in a constant returns world.

In such a world, firms are an artificial entity.<sup>2</sup> It does not matter how the boundary of a firm is drawn or even if it is drawn at all. There is no operational distinction between the size of a firm and the number of firms. In a linearly homogeneous production system, it is immaterial which factor hires which. With sufficient divisibility, the unemployed factor can simply declare itself a miniature firm, hire itself and any other factors it needs, and sell the resulting output directly. Essentially the same idea works if there is some indivisible scale of production small enough not to spoil the market, after which returns are constant. The operational requirement is that the efficient minimum-cost scale of production be

sufficiently small, relative to the size of the market, that any one firm or plant cannot significantly affect price.

When unemployed factor units are all going about their business spontaneously employing themselves or being employed in this way, the economy will automatically break out of unemployment. While the simple story of supply creating its own demand can be told best in a closed barter economy, I do not see the existence of money, saving, or investment per se invalidating the basic proposition that a logical inference of strict constant returns to scale and perfect competition is full employment.<sup>3</sup> With sufficient divisibility in production, each unemployed factor unit has an incentive to produce itself out of unemployment and market the product directly. In effect, the unemployed are induced to create on their own scale an exact replication of the full employment economy from which they have been excluded.

Note that price flexibility alone guarantees at most the correct relative proportions in any general equilibrium production system with constant returns to scale. The absolute factor employment level represents an extra degree of freedom which must be pinned down by some direct quantity adjustment.

"Say's Law of Markets", the doctrine that supply creates its own demand, is understood here as a name for the kind of story being told about a quantity adjustment mechanism which increases output when there is slack capacity. The parable describes how an economy can automatically produce itself out of unemployment by a balanced expansion kind of bootstraps operation. However muddled its initial expositions, Say's Law represents an

early piece of general equilibrium dynamics which is neither trivial nor unimportant.<sup>4</sup>

The role of Say's Law as an adjustment parable is crucial to the classical belief that underlying forces tend to restore the economy away from "temporary derangements" back toward full employment equilibrium.

J.S. Mill was categoric about the importance of Say's Law: "The point is fundamental; any difference of opinion on it involves radically different conceptions of Political Economy, especially in its practical aspect." If Say's Law is not accepted, Mill wrote, economists must consider not only the allocation of a given volume of resources, but also "how a market can be created for produce, or how production can be limited to the capabilities of the market."<sup>5</sup>

Of course Say's Law of Markets has become a favorite whipping boy since the General Theory. But given classical assumptions of strict constant returns to scale and pure competition, the doctrine seems a perfectly logical theoretical proposition. Furthermore, although this is a separate issue, one suspects that Say's Law was probably not a terrible empirical description of how certain economies tended to automatically adjust themselves toward full employment at around the time Say was popularizing the doctrine.

The world in which Say and Ricardo lived was an economic society that has since largely passed away and, somewhat ironically, was fading at the very time it served the classical economists as an inspiration for so many useful parables. This was a world where most producers were either peasant farmers or master craftsmen. When labor was hired, it was typically by individual proprietors on a small scale. Agriculture was the overwhelmingly

predominant economic activity. To "manufacture" -- the word literally means "make by hand" -- was basically to employ oneself, perhaps with a few others, by setting up shop. The example most clearly epitomizing this vanished world is the domestic system where cottage industry and agriculture were carried out by the entire family almost as an integrated enterprise.

Whether or not constant returns to scale and pure competition was ever a fair abstraction of a real economy, the Industrial Revolution represented an unequivocal triumph of the factory system with its overwhelming economies of scale. The reasons for increasing returns are anything that makes average productivity increase with scale -- such as physical economies of area or volume, the internalization of positive externalities, the law of large numbers, access to financial capital, economizing on information or transactions, use of inanimate power, division of labor, specialization of roles or functions, standardization of parts, etc., etc. Constant returns means that average productivity is the same for all scales larger than some reasonably small indivisibility threshold. Only increasing returns causes a genuine separation of aggregate factor from the product it produces.

This is not the place to get overly involved in a debate about the actual extent of increasing returns in the real world. Economists who want badly enough to have a perfectly competitive economy will see increasing returns limited to a finite (and hopefully small -- relative to the size of the market) initial production phase, after which the long run U-shaped average cost curves turn up, or at least become horizontal. For my part, I join others in seeing abundant evidence that significant economies of scale are a pervasive feature of the modern industrial world.

The seemingly institution-free or purely technological question of the extent of increasing returns is a loaded issue precisely because the existence of pure competition is at stake. The classical economists do not seem to face this issue head on, although their theories of value indicate they were often thinking in terms of constant returns to scale. Somewhat ironically, Adam Smith (whose invisible hand paradigm ultimately rests on convexity assumptions) also believed the division of labor is limited by the extent of the market, essentially a doctrine about the strength of increasing returns.

To dramatically emphasize a basic truth, let the case be overstated here. Increasing returns, understood in its broadest sense, is the natural enemy of pure competition and the primary cause of imperfect competition. (Leave aside such rarities as the monopoly ownership of a particular factor.) Once you agree you are observing a species of what might be called "market economy", "private enterprise", or "laissez-faire", you have, so to speak, only two further sub-species to investigate. You are looking at pure competition if there are universal constant returns to scale in every aspect of technology (including the acquisition of knowledge and the transmission of information). You are looking at imperfect competition if there are increasing returns to scale.

Therefore, if you want to build from first principles a broad based microeconomic foundation to a general equilibrium theory that will explain involuntary unemployment, you must start with increasing returns and go the route of imperfect competition. Otherwise, you will forever be struggling in one way or another to evade the basic truth of Say's Law under strict

constant returns to scale. Modeling the failure of coordination implicit in an 'inability to communicate effective demand' requires increasing returns and product diversity.

Of course the practical macroeconomist may wish to knock down the straw man of Say's Law at the very beginning and go right to a macroeconomic formulation of the problem. The task here is a different one. Instead of avoiding the issue by asserting, quite correctly, the empirical proposition that Say's Law does not hold in a modern industrial economy and moving on to practical matters, I want to sketch out what I think is involved in building up from first principles a consistent microeconomic foundation for unemployment equilibrium theory.

### III: Large Scale Specialization under Increasing Returns to Scale

Continuing with the metaphor of stages of technological development, suppose that increasing returns to scale in specialized production has been introduced. More specifically, let the production function for any particular commodity be of the form

$$Y = \max\{0, \gamma(L-F)\} \quad (3)$$

where  $Y$  is output, and  $L$  is the total labor applied (the "type" of labor does not matter in this mode).

To produce any output at all in this new mode amount  $F$  of the factor (measured as a flow of services) must be committed to "overhead". It is intended that at "reasonable" production scales, denoted  $L_r$ , the average product of labor is significantly higher under large than under small scale

specialization,

$$\gamma \left(1 - \frac{F}{L_r}\right) \gg \beta. \quad (4)$$

That way we can think of the new technology as clearly dominating the old.

In this paper the basic unit of production is the plant or the firm, no distinction being made between the two concepts.

The specific form of production function (3) is chosen because it is easy to work with and interpret. More general production functions showing increasing returns would give similar results.

At the aggregation level of the model, it is difficult to identify the source of the increasing returns (remember that  $L$  stands for all factors of production), nor does it really matter. Any or all of the usual reasons might be given. It is intended in this paper that the term "increasing returns" be understood as a generic label for all phenomena causing average productivity to rise with scale.

For ease of exposition, and later to be changed, we assume that the increasing returns mode represented by (3) is the only available method for producing commodities. An unemployed worker receives a zero wage instead of the comparatively miniscule amount he would earn by retreating into the "second economy" of stage II or the even tinier reward available in stage I. We return to these matters afterwards.

Let the nominal wage paid by each large scale firm be parametrically fixed at some value  $w$ . As an expository simplification, suppose that aggregate demand is maintained at the hypothetical level which would be generated if the source of all spending were factor income at an unemployment



rate  $u$ . We shall solve for the equilibrium prices and outputs of products and the equilibrium number of firms.<sup>6</sup>

Suppose there are  $m$  firms or plants producing  $m$  different products spaced equally around the attribute circle, where for the moment we think of  $m$  as some large exogenously fixed number. The distance in attribute space between the products of any two factor units is  $\frac{H}{m}$ . Let all plants charge a nominal price  $\bar{p}$  for their product. We assume that firms set prices and react with quantities.

Allow any one firm to vary the price of its output. If the firm charges a price  $p$ , any worker specialized to buying the firm's product will purchase  $\frac{w}{p}$  units. In attribute space, suppose the firm is able to attract customers with attribute types in a range of  $\frac{-h(p)}{2}$  to  $\frac{+h(p)}{2}$  centered on the particular commodity attribute the firm is producing. This is the firm's "market area". The marginal buyer must be located right on the boundary at an attribute distance  $\frac{h(p)}{2}$  from the firm and  $\frac{H}{m} - \frac{h(p)}{2}$  from the firm's nearest neighbor. By (1), the buyer who is just indifferent between purchasing from the firm or its nearest neighbor must satisfy

$$\frac{w}{p} - \mu \left( \frac{h(p)}{2} \right) = \frac{w}{\bar{p}} - \mu \left( \frac{H}{m} - \frac{h(p)}{2} \right), \quad (6)$$

which can be rewritten

$$h(p) = \frac{H}{m} + \frac{1}{\mu} \left( \frac{w}{p} - \frac{w}{\bar{p}} \right) \quad (7)$$

The total number of customers buying from the firm is  $n(p)$ , where

$$\frac{n(p)}{h(p)} = \frac{N(1-u)}{H} . \quad (8)$$

Combining (7) and (8),

$$n(p) = \frac{N(1-u)}{H} \left( \frac{H}{m} + \frac{1}{\mu} \left( \frac{w}{p} - \frac{w}{\bar{p}} \right) \right). \quad (9)$$

With each customer buying  $\frac{w}{p}$  units, the total demand faced by the firm is

$$d(p) = \frac{w}{p} \times n(p). \quad (10)$$

Substituting from (9) into (10) and rearranging, the demand curve for the firm's product is

$$d(p) = \frac{N(1-u)w}{m} \left( \frac{1}{p} \right) + \frac{N(1-u)w^2}{H\mu} \left( \frac{1}{p} \right) \left( \frac{1}{p} - \frac{1}{\bar{p}} \right) \quad (11)$$

It will be convenient to introduce new constants  $a$  and  $b$ , and rewrite (11) as

$$d(p) = a \left( \frac{1}{p} \right) + b \left( \frac{1}{p} \right) \left( \frac{1}{p} - \frac{1}{\bar{p}} \right) \quad (12)$$

where

$$a = \frac{(1-u)Nw}{m} \quad (13)$$

$$b = \frac{(1-u)Nw^2}{H\mu} \quad (14)$$

In a symmetric Nash equilibrium in prices,  $p = \bar{p}$ .

The elasticity of the demand function (12) evaluated at  $p=\bar{p}$  is

$$E = 1 + \frac{b}{ap} \quad (15)$$

The marginal cost of producing an extra unit of output is

$$\frac{w}{\gamma}$$

Using the profit maximizing monopoly pricing formula<sup>7</sup>

$$p \left( 1 - \frac{1}{E} \right) = \frac{w}{\gamma} \quad (16)$$

and substituting from (15), we have

$$p = \frac{wb}{\gamma b - wa}. \quad (17)$$

Substituting from (13) and (14), expression (17) becomes

$$p = \frac{w}{\gamma(1 - \frac{H\mu}{\gamma m})}. \quad (18)$$

Given  $m$ , (18) determines the equilibrium price to wage ratio. There is no incentive for any firm to change its level of factor employment because the marginal revenue product of an extra worker equals the marginal cost when (18) holds.

In  $p = \bar{p}$  equilibrium, from (12),

$$d = \frac{a}{p}. \quad (19)$$

Substituting from (13) and (18) into (19),

$$d = \frac{\gamma(1-u)N}{m} (1 - \frac{H\mu}{\gamma m}). \quad (20)$$

Now think of  $m$  as variable. If there is free entry and exit, and if it is costless to relocate, the number of factor units should adjust to yield zero pure profits in equilibrium. (Remember, all factors are subsumed in "labor" -- there is no genuine entrepreneurial ability per se.) Behind this solution concept is some complicated dynamic story about the lure of eventual profits encouraging a new firm to establish a foothold between existing firms and to stubbornly wait out the adjustment period of price warfare until neighboring firms are convinced to move aside in the product spectrum. The story can only be defended as an approximation. Entry and exit are complicated phenomena, involving difficult game theoretic issues that defy neat analytic formulation. If the number of plant openings is roughly

proportional to existing profits per plant, then in equilibrium there will be zero pure profits<sup>8</sup>, or:

$$pd = w(F + \frac{d}{\gamma}). \quad (21)$$

Expression (21) can also be interpreted as an equilibrium condition guaranteeing that the total amount of factor which the firms wish to hire at a certain level of aggregate demand will actually generate that level of aggregate demand when the factor income is spent.

Substituting from (18) and (20) into (21) and solving the resulting equation for the equilibrium number of firms, we have

$$m = \sqrt{\frac{(1-u)NH\mu}{\gamma F}}. \quad (22)$$

Then substitute (22) into (18) and (20), yielding

$$p = \frac{w}{\gamma(1 - \sqrt{\frac{H\mu F}{(1-u)N\gamma}})} \quad (23)$$

$$d = \gamma F \left( \sqrt{\frac{(1-u)N\gamma}{H\mu F}} - 1 \right) \quad (24)$$

Substituting into (15), the equilibrium elasticity of demand for a firm's product is

$$E = \sqrt{\frac{(1-u)N\gamma}{H\mu F}} \quad (25)$$

While equations (22)-(25) have been derived as if  $u$  and  $w$  were given, in fact it is better to think in terms of simultaneous equilibrium relations holding among all the variables. When envisioning how Say's Law might operate under increasing returns, it is more useful to invert (22) and see  $m$  as determining  $u$  by the equation

$$u = 1 - \frac{\gamma F m^2}{N H \mu} \quad (26)$$

If only there were an incentive to increase  $m$ , it would translate into an automatic mechanism for pushing down  $u$ .

Equilibrium in the present context means that real magnitudes are constant, whereas no restriction is placed on the behavior of nominal prices. At least in principle there could be proportional inflation or deflation.<sup>9</sup>

Of course, if equilibrium is defined to mean only the Walrasian concept, there can be no involuntary unemployment in equilibrium by definition.

Perhaps the time period most compatible with a variable number of factor units playing a significant adjustment role is some conveniently vague interpretation of the "medium term". Which equilibrium the economy converges to depends in general on dynamic specifications, adjustment speeds, and initial conditions.

Note that as the fixed charge  $F$  goes to zero, the stage III economy approaches a perfectly competitive equilibrium.

From (23), (24), an increase in  $N(1-u)$  causes both the total number of plants and the output of each plant to go up.<sup>10</sup> Deepening the extent of the market encourages firms to take greater advantage of economies of scale. This is an example of Adam Smith's famous doctrine that specialization is limited by the extent of the market. The case of interest is  $N(1-u)$  relatively large, so that  $m$  is also big. This justifies the assumption that when a firm hires a worker there is no effect on its own demand. A large population also guarantees

$$FH\mu < (1-u)N\gamma, \quad (27)$$

a viability condition needed to ensure that monopolistic competition is sufficiently competitive to not degenerate into a form of monopoly.

We have been assuming that wages of the unemployed are zero. Actually, workers not employed in large scale industry are free to revert back to the dual economy of Stage II. Provided  $m$  is sufficiently large to make the large scale firms relatively dense along the attribute circle, we can think if we wish in terms of two almost decomposable economies. The primary economy consists of large scale firms. The secondary economy is based on small scale specialization of stage II. Provided  $m$  is large enough, there is no harm in thinking of the two economies as if they were almost self sufficient, with the workers in each sub-economy spending only on the products of their own sub-economy. (There is a minor effect whereby small scale workers with a comparative advantage in producing commodities of an attribute type between two large scale firms receive a slightly higher return.)

The ratio of wages of workers in large scale production to wages of workers in small scale production is

$$\frac{w}{w_u} = \frac{\gamma}{\beta} \left( 1 - \sqrt{\frac{H\mu F}{(1-u)N\gamma}} \right) \quad (28)$$

so that with (4) holding it is easy to imagine parameter configurations causing

$$w \gg w_u. \quad (29)$$

### Unemployment Equilibria

In the present model, any level of steady state unemployment is consistent with a self-fulfilling rational expectations equilibrium. The set of possible equilibria forms a continuum. When there is greater unemployment, purchasing power is diminished, which sustains a lower level of employment. If for any reason the economy gets stuck in a low employment equilibrium, left alone it will tend to remain there. The basic steady state tendency of the model can be fairly described as unemployment inertia.

From (23), the equilibrium real wage is

$$\frac{w}{p} = \gamma \left( 1 - \sqrt{\frac{H\mu F}{(1-u)N\gamma}} \right). \quad (30)$$

If the nominal wage were changed in a kind of ceteris paribus experiment, the first order effect is a proportional change in aggregate demand. Consistent with the spirit of cost plus monopoly pricing, the nominal price of commodities should adjust in approximately the same proportion to leave the real wage and the unemployment rate unaltered. Implicit in such a statement is a dynamic adjustment mechanism which has the firms wait to see the new pattern of demand before revising price, output, and employment decisions. Ignoring second order effects, the new profit maximizing equilibrium would involve an equiproportionate change in prices, all real variables remaining the same.<sup>11</sup>

An important inference of the present analysis is the idea that, in an increasing returns system, the equilibrium tradeoff between real wages and employment will tend to make ordinary wage adjustment mechanisms ineffective or unstable. Even if it could be done, an all round reduction of real wages

cannot cure unemployment. Firms would find it cheaper to hire labor, but this effect is outweighed by a simultaneous decline in the demand for their products. Equation (30) shows that a successful attempt to depress real wages would actually increase the equilibrium level of unemployment.<sup>12</sup> The implication would seem to be that wage and price flexibility cannot make this kind of economy self correcting. Under such circumstances, wage stickiness may actually be a blessing.

The discussion in terms of hypothetical wage cuts is somewhat artificial. Perhaps a better way of stating the relation implicit in (30) is to say that equilibrium changes in employment are accompanied by procyclical movements in productivity and real wages.

The potential for unemployment equilibrium is created by increasing returns in the production of a large number of different products. These are precisely the conditions conducive to monopolistic competition. There is a sense, therefore, in which the natural habitat of effective demand macroeconomics is a monopolistically competitive microeconomy. Analogously, perfect competition and classical macroeconomics are natural counterparts.

Behind a mathematical veneer, the arguments used in the new classical macroeconomics to discredit steady state involuntary unemployment are implicitly based on some version or other of Say's Law.<sup>13</sup> It is true that under strict constant returns to scale and perfect competition, Say's Law will operate to ensure that pockets of unemployment are automatically eliminated by the self interested actions of economic agents. But increasing returns prevents supply from creating its own demand because the unemployed workers are effectively blocked from producing.<sup>14</sup> Either the existing firms



won't hire them given the current state of demand, or, even if a group of unemployed workers can be effectively coalesced into a discrete lump of new supply, it will spoil the market price before ever giving Say's Law a chance to start operating. Correcting this "externality", if that is how it is viewed, requires nothing less than economy-wide coordination or stimulation. The usual invisible hand stories about the corrective powers of arbitrage do not apply to effective demand failures of the type considered here.

In increasing returns equilibrium, at every unemployment level there is no incentive for a firm to hire more workers. Reducing wages in any one particular firm will certainly induce that particular firm to employ more workers because costs are reduced while demand is unaffected. But in a symmetric situation, wage pressure on any firm should represent wage pressure on all firms. At least as an approximation or norm, a law of one wage should prevail.<sup>15</sup> As we have seen, an all round change in the going nominal wage feeds back through aggregate demand and probably has no real effect, whereas cutting the real wage actually increases equilibrium unemployment.

With economies of scale, in zero-profit equilibrium there is a kind of natural barrier to further entry. If a new firm were to invade an existing market area, its size would spoil the prices it and its neighbors receive before adjustments can occur in the product spectrum. When there are no pure profits to begin with in such situations, Say's Law is frustrated from operating effectively. Under anything resembling a uniform wage structure, no firm would have an incentive to enter because it must suffer an initial discrete loss followed, at best, by zero profits in the long run. Who would underwrite market penetration experiments of that sort? If the law

of one wage paid by all firms to all employed workers is accepted as a valid approximation, then only in the limit as the degree of increasing returns is negligible can there be intentional entry into a zero profit market.

At any equilibrium employment level of the present model, total spending on the product equals aggregate factor payment. This reflects the idea that the primary source of current purchasing power is current income. While systematic deviation from this steady state norm is not to be expected, trade can become uncoupled in a monetary economy and intended aggregate demand for commodities may instantaneously exceed or fall short of factor cost for a variety of reasons. When they occur, such autonomous spending shocks are disequilibrating. The amount demanded is more or less than what has been produced. Factor units will be induced to expand or to contract in size, and number as pure profits temporarily become positive or negative. Without further shocks, the system will gravitate toward some new equilibrium state at higher or at lower employment levels, where it will tend to remain. Naturally, the exact details of any particular dynamic adjustment depend on specific assumptions, but the broad tendencies should be reasonably clear.<sup>16</sup>

If intended aggregate spending can shift over time but within any adjustment period bears a sufficiently stable and systematic short term relation with national income to be considered a true function of it, then equilibrium is reestablished at the "Keynesian cross" where the two are equal, and the usual multiplier effect can take hold.

Hysteresis effects are a significant part of the unemployment story being told here.<sup>17</sup> Basically, the system is sticky and tends to remain where

it is unless there are external disturbances which change the state variables.

In some sense the fundamental message is that if for any reason a recession becomes convincingly protracted -- whether the original cause lies in stock market crashes, oil price increases, curtailed investment spending, or whatever other shocks -- an automatic mechanism such as Say's Law will not operate to homeostatically draw the economy back to its previous level. Like a self-fulfilling prophesy, once the expectation of aggregate demand associated with a given employment level becomes ingrained, it turns into a major cause of its own persistence. If plants are closed and business confidence is damaged, the condition tends to replicate itself. That sort of effect was almost surely the main source of the momentum that kept the Great Depression going, even though economists to this day are unsure what started it in the first place.

The model is much too crude for specific policy prescriptions, but it does suggest a pump-priming government strategy aimed at shocking a depressed economy into states of full employment and keeping the pump running long enough to build up perceptions of high aggregate demand. If total spending can be maintained at a level consistent with some hypothetical employment rate, at least in principle the employment will actually materialize and become self sustaining.



Conclusion

Is involuntary unemployment possible in a steady state equilibrium where intended aggregate spending equals total factor income?

The 'classical' answer is no. In one form or another, Say's Law will cause an economy to automatically break out of unemployment.

The 'Keynesian' answer is that underemployment can persist because self correcting forces are weak or non-existent. Grounding such an idea firmly in basic principles has been a major challenge to economic theory.

This paper argues that increasing returns to scale, understood in a broad sense, is the primary obstacle blocking unemployed factor units from producing on their own. When Say's Law is thus stymied, the easy road to automatic full employment is closed.

FOOTNOTES

<sup>1</sup>There is by now a vast literature on the microeconomic foundations of unemployment. The references contain a sample of works most directly relevant to the present paper. Equilibrium and disequilibrium approaches are both represented. It would be a tedious exercise to go through the various models seriatim, listing particular differences and similarities with the model of this paper. Instead, some general comments are offered. In contemporary models, the crucial role of Say's Law as an adjustment mechanism does not seem to be addressed directly. The literature does not emphasize the connection between macroeconomic unemployment and microeconomic returns to scale. If there is monopolistic competition, the firm typically faces a "perceived" or "conjectural" demand curve rather than the "real" demand of the present approach. An exception is the model of Hart (1979), which differs from the present formulation in a number of ways, including non-increasing returns, a fixed number of firms, and voluntary unemployment essentially caused by a 'too high' monopoly price. Although his search theoretic framework is quite different, Diamond's (1981) model served as an intellectual inspiration because of the way he grounds steady state involuntary unemployment firmly in basic principles.

<sup>2</sup>For a view of the concept of the firm implicit in classical general equilibrium theory, see, e.g., Koopmans (1957), Samuelson (1967), Arrow (1971), or McKenzie (1981).

<sup>3</sup>Drazen (1980) contains a careful rebuttal of the idea that money as a constraint on transactions is central to understanding unemployment. Typically, it is too much aggregation in simple models which leads to the mistaken notion that the cause of effective demand failures is the monetary exchange requirement. As for hoarding a non-produced asset, even with this feature the basic issue remains how, in a world of constant returns and perfect markets, equilibrium can persist when an unemployed factor unit could break itself out of unemployment by producing directly. While it is possible to tell more complicated and realistic stories, the financial system I have in mind for this essay uses just the simplest kind of pure inside money. Essentially, money is credit. At negligible cost, banks issue short term credit to any firm that can repay loans for the hiring of productive factors. Note that the distinction between a money and a barter economy is blurred for the case of perfect competition, but the existence of a general unit of account in which factor payments must be denominated becomes important when producers are able to influence prices.

<sup>4</sup>This is essentially the interpretation of Schumpeter (1954).

<sup>5</sup>Principles of Political Economy, chapter XIV. Mill expounded a more detailed analysis of the theory behind the classical position in his remarkable essay, originally written in 1829-1830, "On the Influence of Consumption on Production."

<sup>6</sup>The model is a general equilibrium version of monopolistic competition theory as developed by Hotelling (1929), Chamberlin (1933), Lancaster (1979), Salop (1979), and others. The underlying norm is the "most perfect" competitive equilibrium that could possibly exist under increasing returns.

<sup>7</sup>It can be verified that marginal revenue is falling and marginal cost is constant, so the second order conditions are satisfied. Note that when the firm hires a worker, except with negligible probability there is no effect on its own demand. If the workers of a firm consume primarily what that firm produces, the failure of coordination vanishes.

<sup>8</sup>The story is somewhat easier to accept when it is borne in mind that each firm actually has many more neighbors than two, so that the impacts of changes in one firm are diffused over many adjacent firms. For example, in two dimensional preference space the analogous model would have every firm surrounded by a hexagonal array of six neighbors, instead of two in the analytically more tractable case considered here. There are other ways of closing the model than a zero profit condition, but they typically involve an implicit limitation on "entrepreneurial ability" or whatever else is thought to lie behind an arbitrarily fixed number of firms. Such specifications are incomplete, with unemployment representing a comparative underutilization of the tangible relative to the intangible factor rather than the absolute underemployment of all factors characteristic of ineffective demand. Closing the model by specifying any fixed rate of profit on sales would yield essentially similar properties to those derived here. <sup>2</sup>

<sup>9</sup>The model does not deal with the issue of how the nominal price level is determined, nor is it clear how best to "overlay" such a model with inflation or deflation. Note that in principle it is easy enough to tell the same story about the real part of the model but allow wages and prices to change proportionately in accordance with some ad hoc version of an expectations augmented Phillips curve.

<sup>10</sup>Actually, the major adjustment is by varying the output of each existing firm. The fraction of total output change attributed to entry or exit varies from zero with high fixed costs to one half with low fixed costs.

<sup>11</sup>I am leaving aside redistributions of wealth like the real balance effect.

<sup>12</sup>It is interesting to note that Keynes, writing after the General Theory, offered an explanation of procyclical real wages based on "imperfect competition in the modern quasi-competitive system" where "it is, beyond doubt, the practical assumption of the producer that his price policy ought to be influenced by the fact that he is normally operating subject to decreasing average cost". See Keynes (1939), section V.

<sup>13</sup>To paraphrase Keynes, contemporary economists who might hesitate to agree with Say's Law do not hesitate to accept conclusions which require the doctrine as their premise. Rational expectationist 'unemployment by misperception' is a very different phenomenon from 'ineffective demand unemployment'.

<sup>14</sup>Note that any condition which "blocks" Say's Law can cause unemployment to persist; increasing returns is merely the most convenient label to apply at a high level of aggregation. For example, imperfect capital markets can make it difficult to "produce for oneself"; in effect, though, there is an increasing net return to ownership of the means of production.

<sup>15</sup>Although it represents a simplifying postulate which, in the spirit of macroeconomic theory, allows us to speak of the aggregate wage level, strictly speaking a law of one wage paid by all (existing and potential) large scale firms to all (previously and newly) employed workers is an exogenous specification when the labor market is not clearing. In a Walrasian equilibrium, competition would drive all wages toward equality as well as, more importantly, establishing an aggregate wage level consistent with full employment. In the present model competitive pressure is allowed to influence only the aggregate wage level, without altering its relative profile. Note that assuming a uniform wage structure across firms is very different from assuming nominal wages to be inflexible over time.

<sup>16</sup>Of course, if the economy is continually peppered with shocks it may never attain steady state equilibrium. Even in the most extreme cases of semi-permanent disequilibrium, I would argue it is important to understand whether the endogenous equilibrating tendencies are toward full employment or not. This paper omits an explicit dynamic analysis because preliminary results are messy and do not appear to be especially informative.

<sup>17</sup>The American Heritage Dictionary of the English Language defines hysteresis as "the failure of a property that has been changed by an external agent to return to its original value when the cause of the change has been removed." Just because the present model has Markovian features, it would be misleading to say the unemployment level is indeterminate. The present equilibrium state of the system is a cumulative response to past shocks, all effects of which are completely summarized in the present equilibrium state of the system.



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